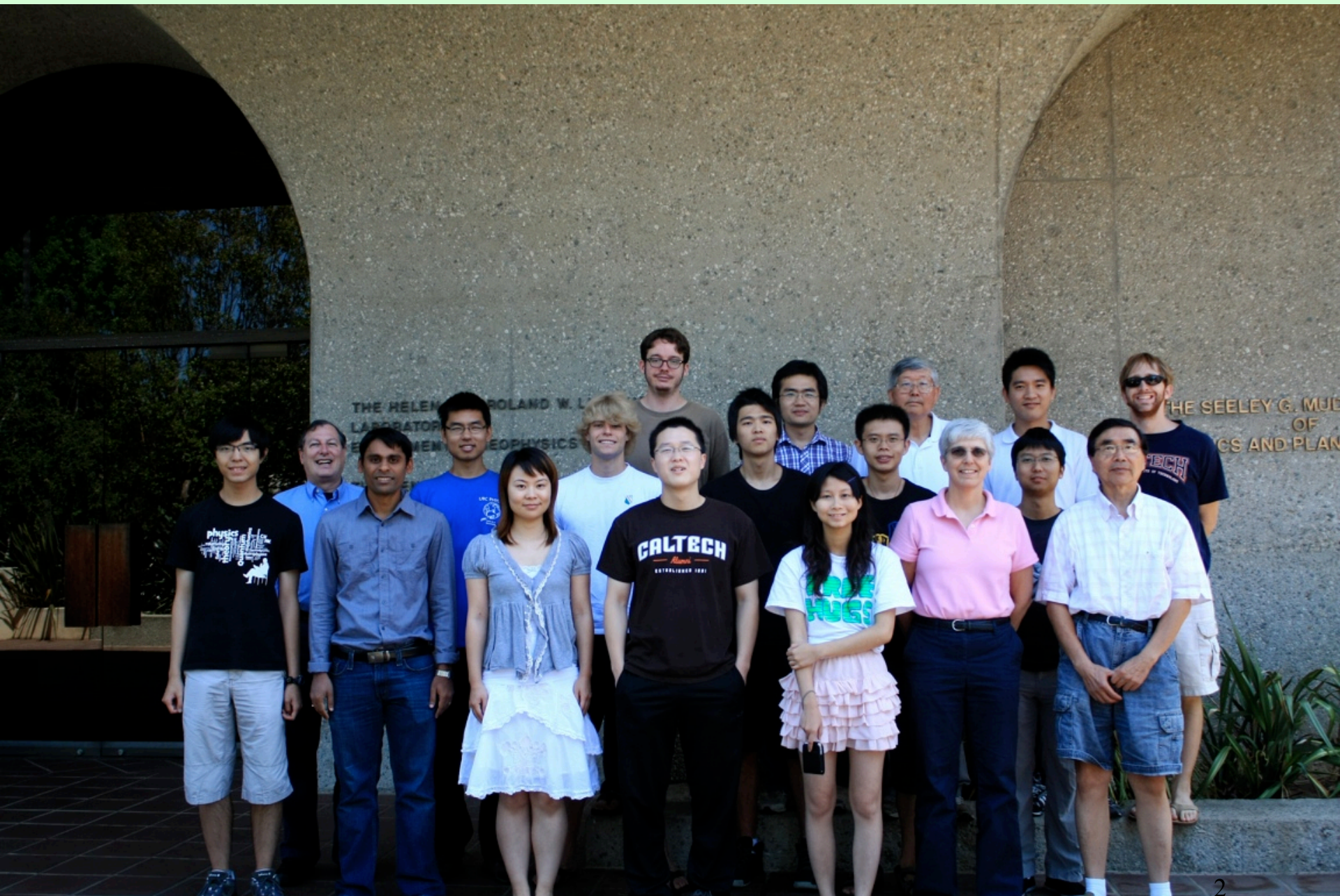


# Tropical Air Temperature from the Troposphere to the Stratosphere from AMSU-A/Aqua Observations

Yuk Ling Yung, H. H. Aumann,  
K. F. Li

AIRS Science Team Meeting

21-22 May 2013



# Overview

- **Part 2. Decadal Record by Aqua over the Tropics**
- **Mode Decomposition (Huang-Hilbert Transform)**
- **Trends**

## **Aqua Temperature Project Collaborators: Shi Yuan, Li King Fai, T. Hou, H. Aumann (Caltech, JPL)**

Shi, Y., K.-F. Li, Y. L. Yung, H. H. Aumann, Z. Shi, and T. Y. Hou. (2013). “*Clim. Dyn.*, in press, doi:10.1007/s00382-013-1696-x.

# Motivation

What are the Natural Variabilities?

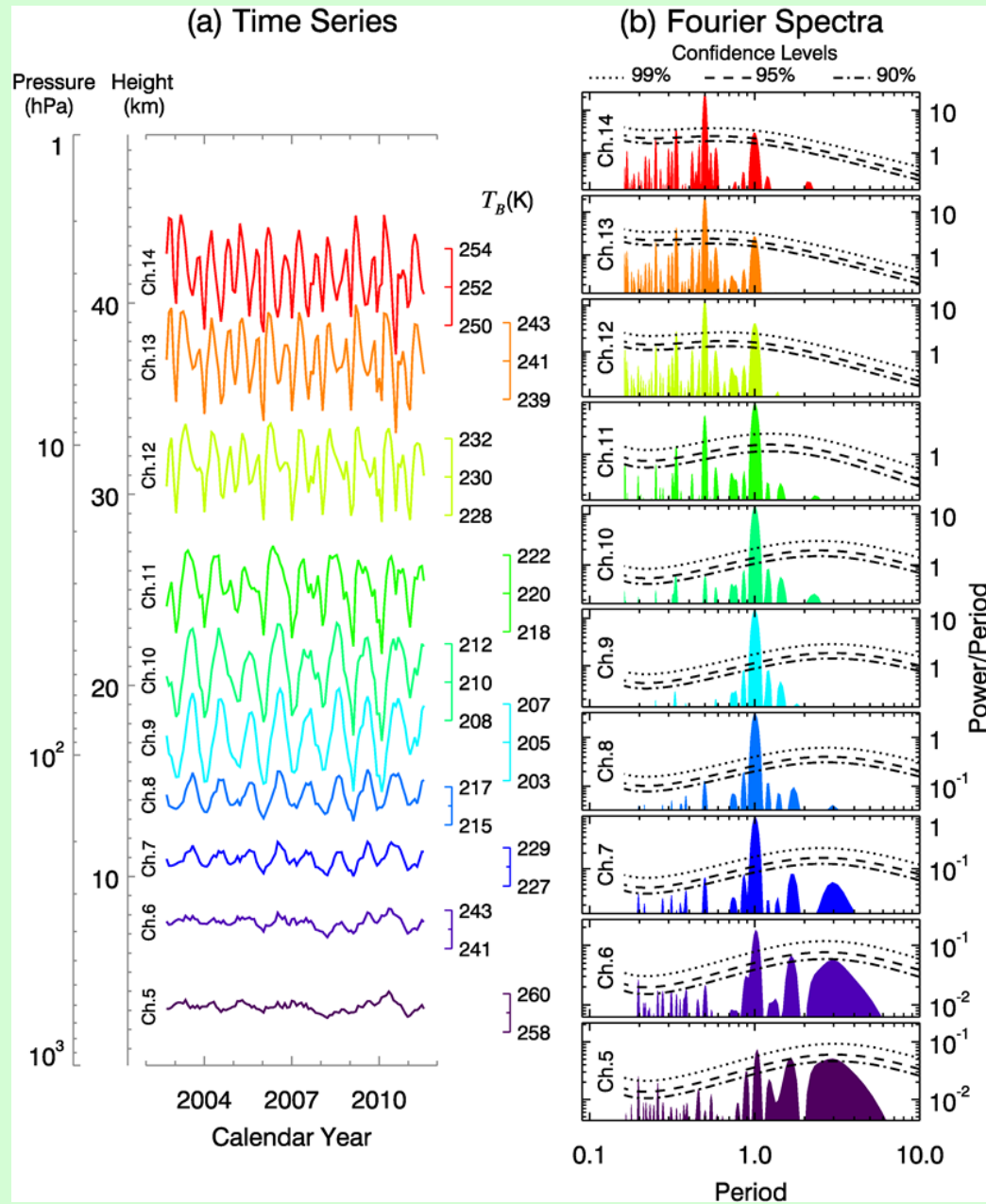
How do we separate them from the Trend?



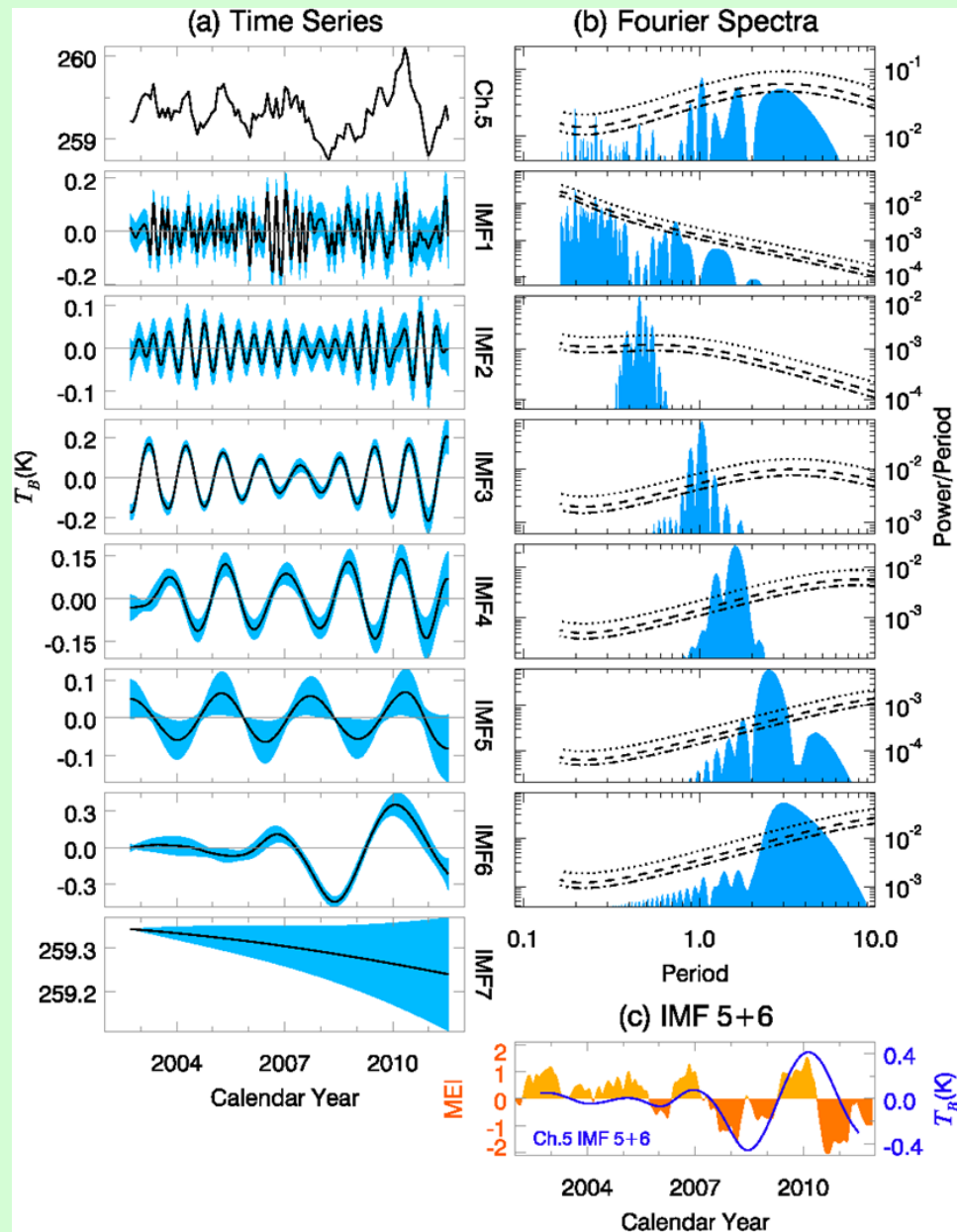
# Advanced Microwave Sounding Unit (AMSU)

<i>Channel number</i>	<i>Peak pressure (hPa)</i>
5	700
6	400
7	250
8	150
9	90
10	50
11	25
12	10
13	5
14	2.5

# Raw data

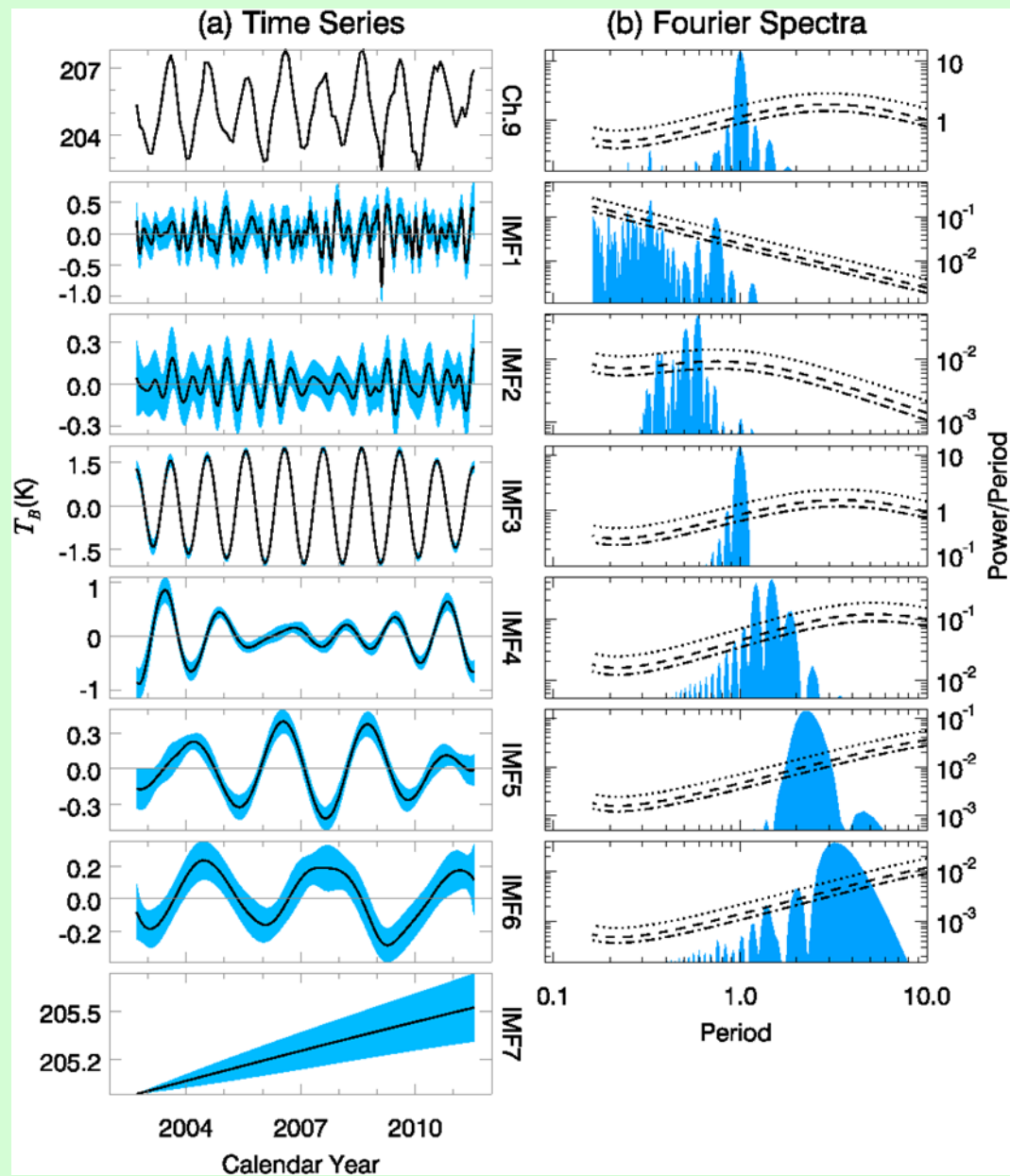


# Channel 5

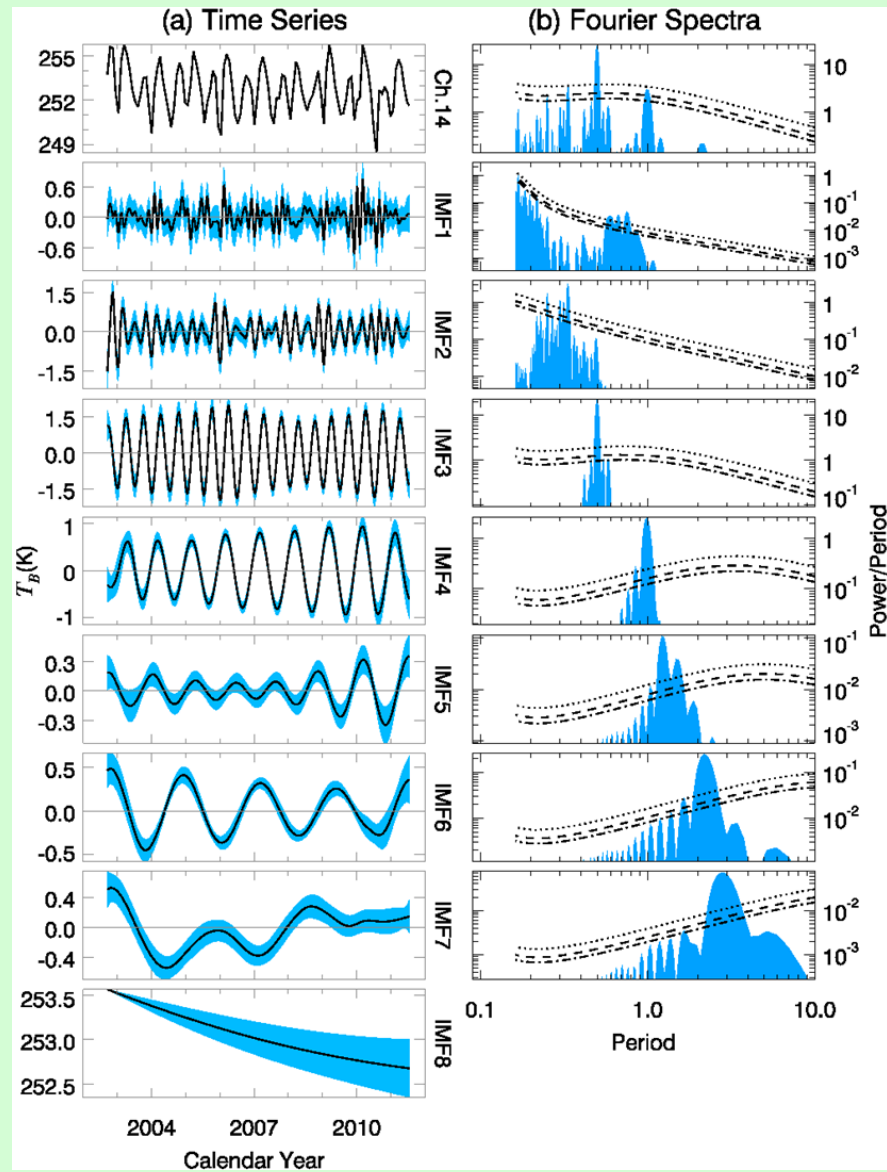




# Channel 9

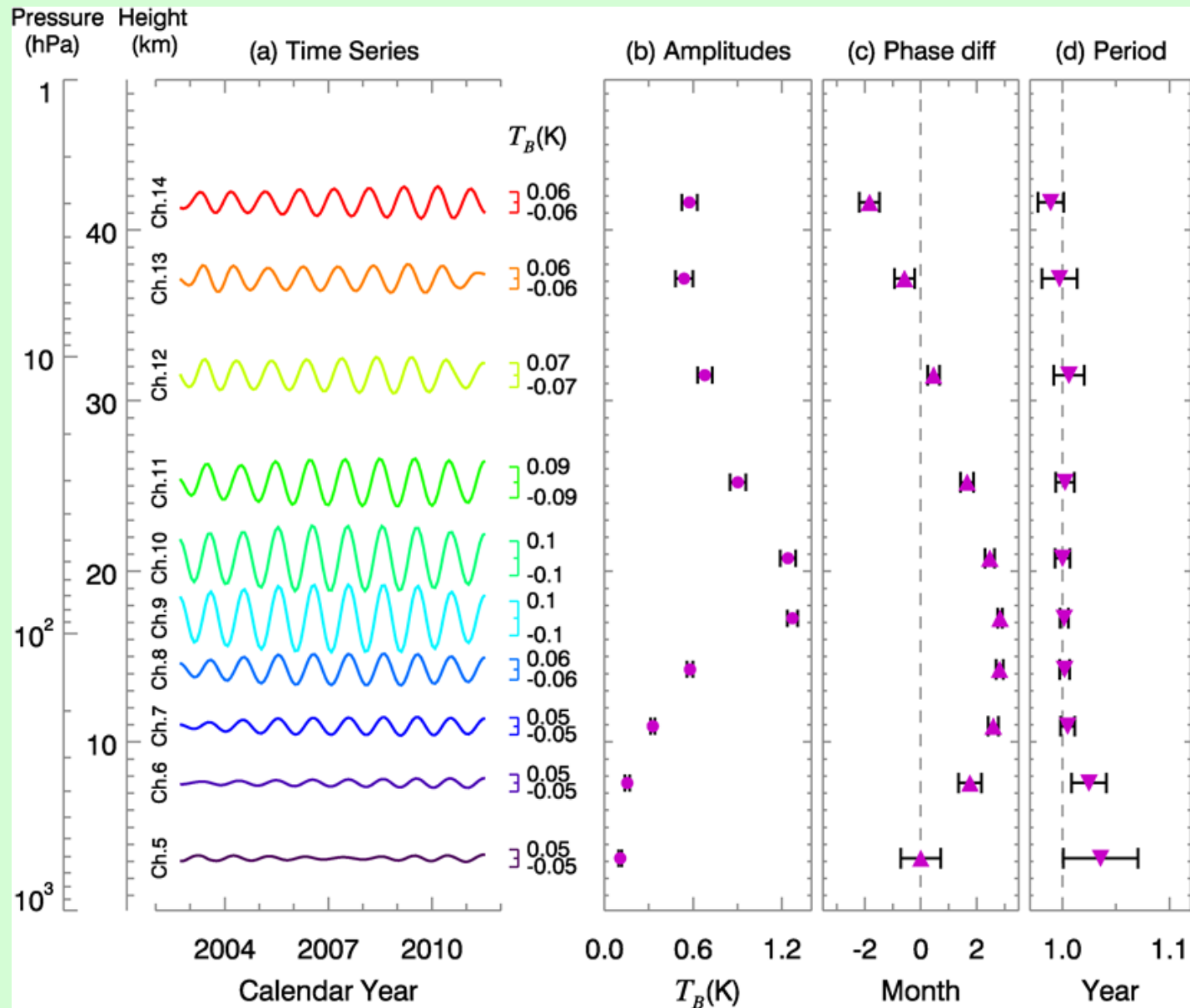


# Channel 14

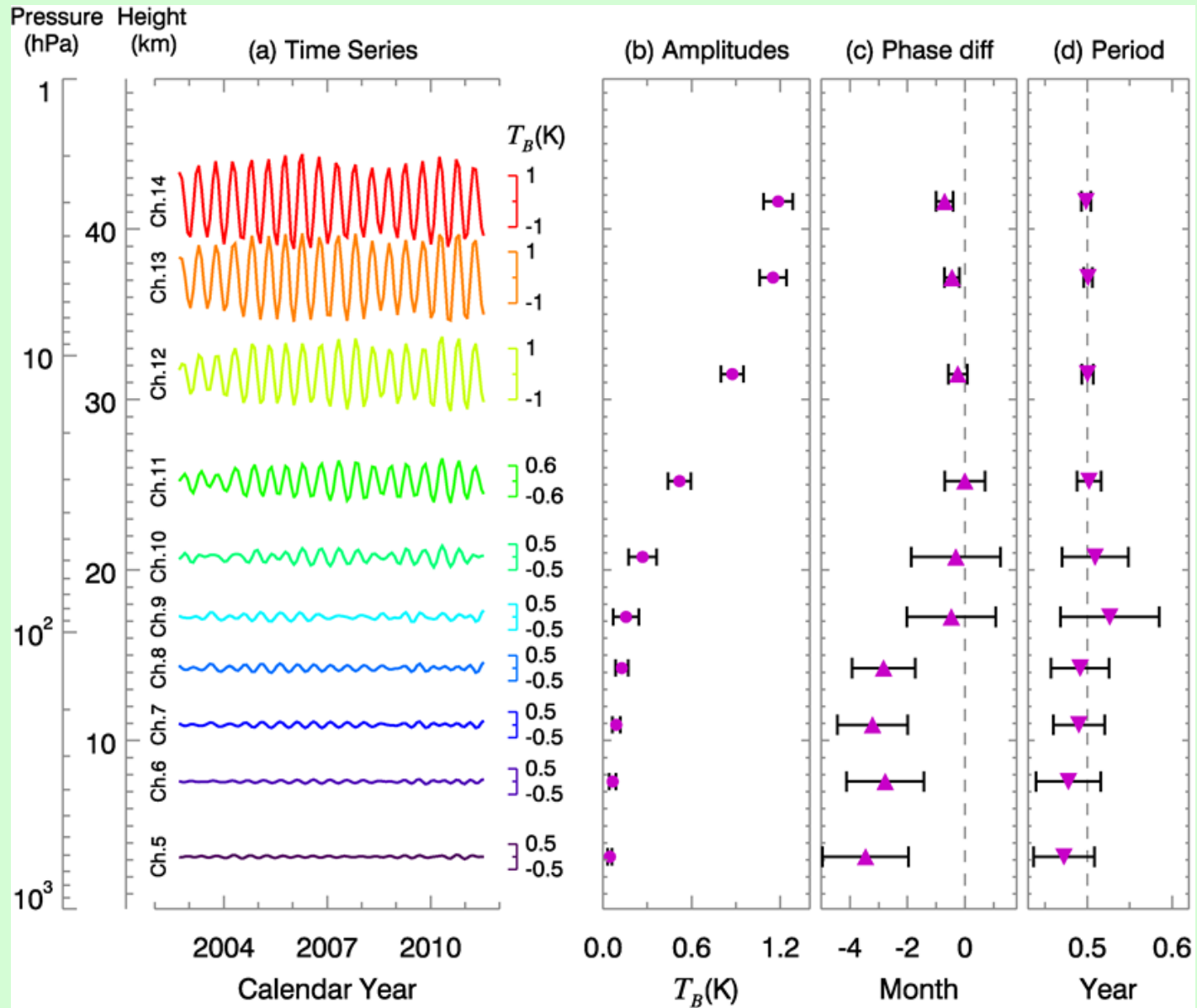


# Annual and Semi-annual Cycles

# Seasonal Cycle



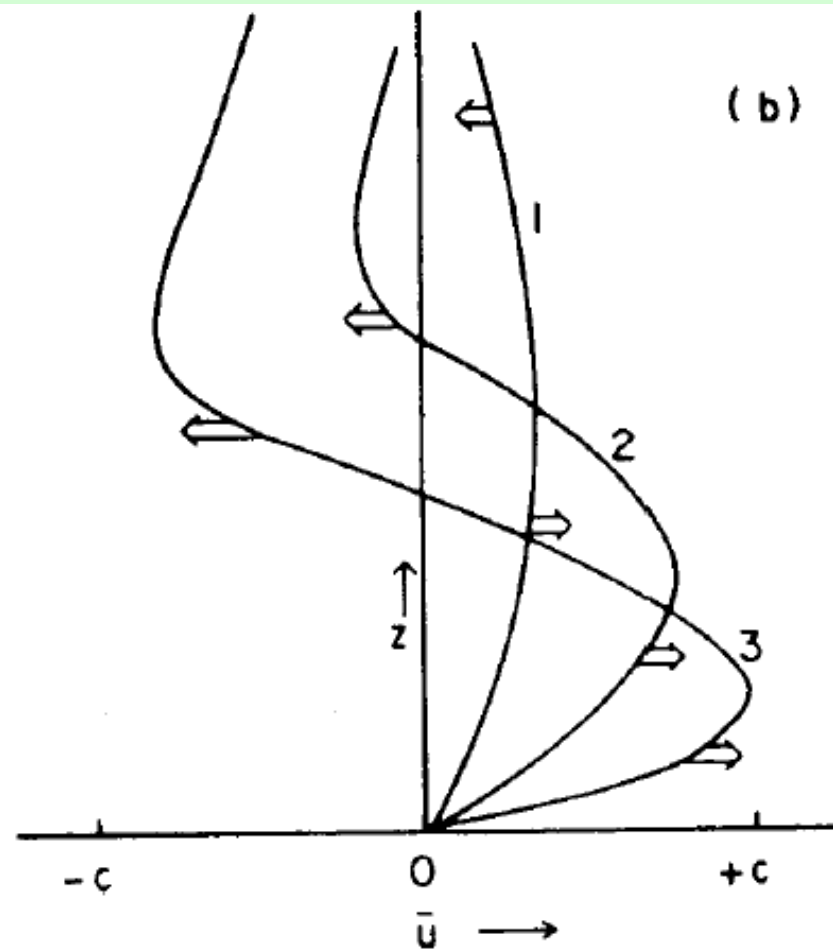
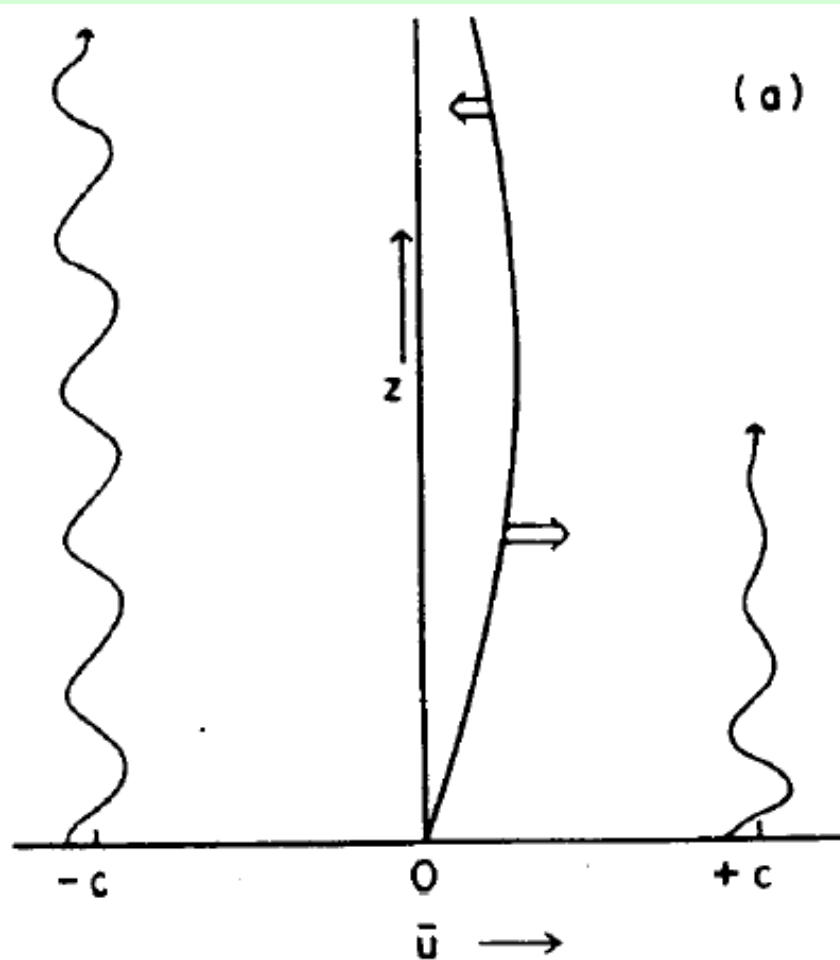
# SAO



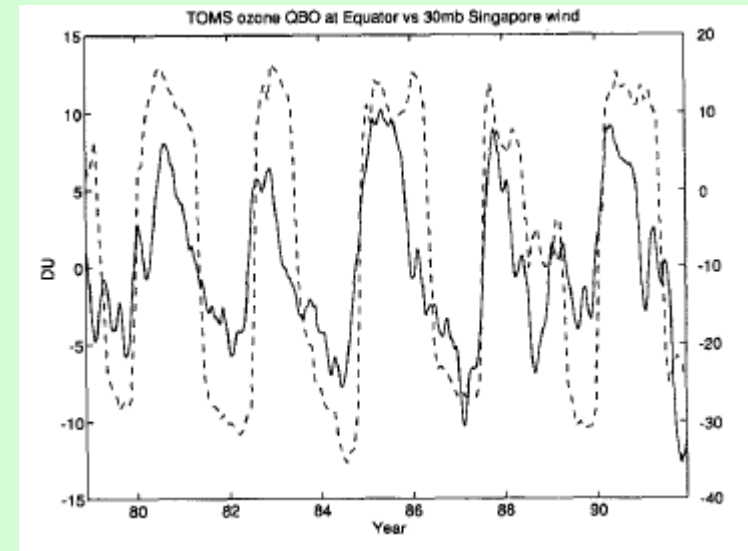
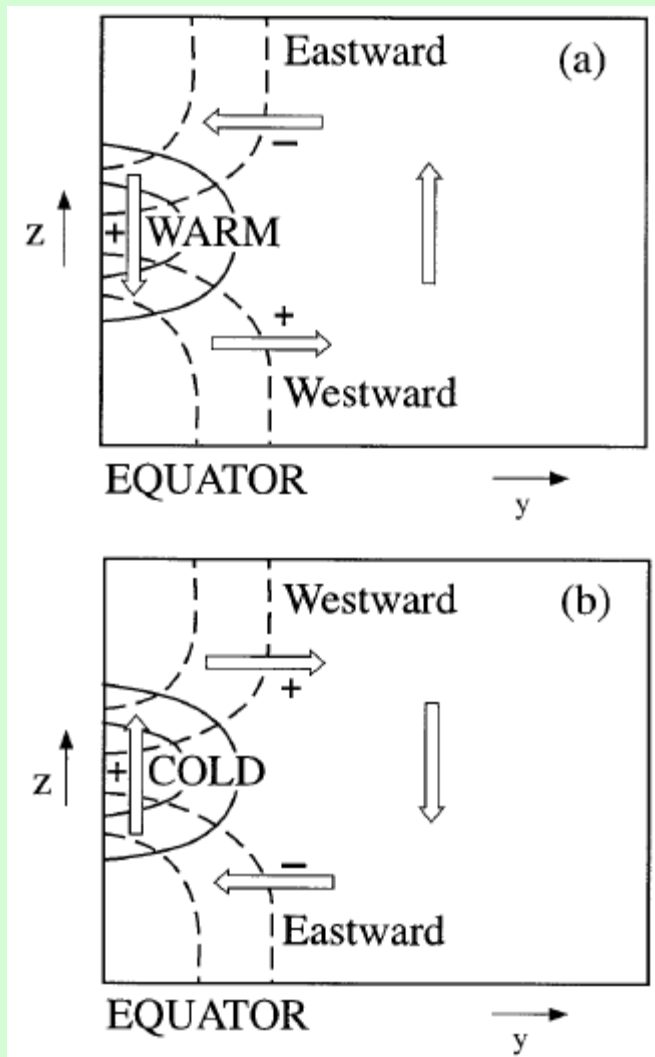
QBO



# QBO mechanism



# QBO induced circulation and its modulation of the Column Ozone

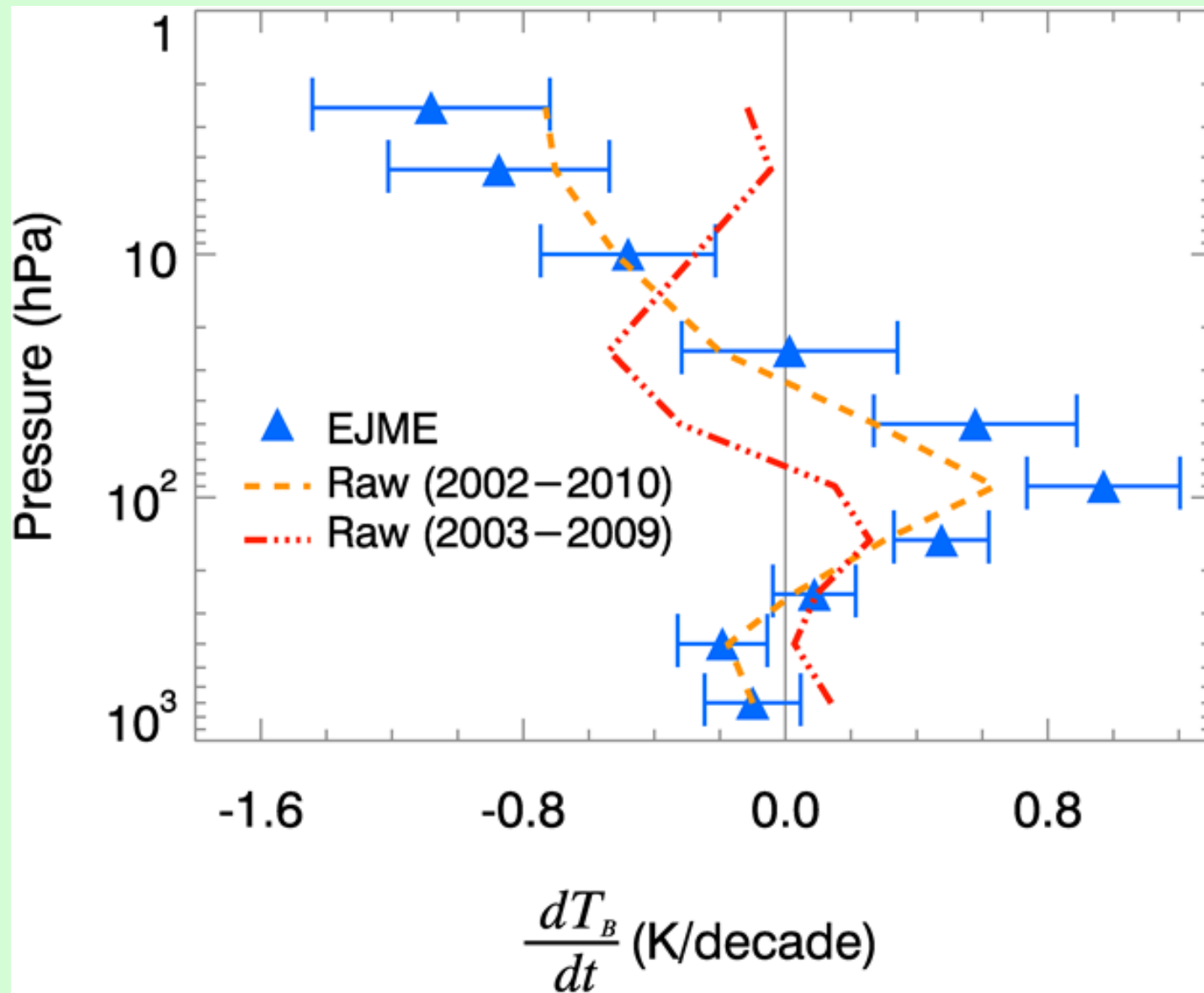


- When the QBO is in the westerly (easterly) phase, there is descending (upwelling) anomalous motion in the tropical stratosphere and upwelling (descending) anomalous motion in the subtropical stratosphere (Plumb and Bell, 1982).
- This results in more (less) ozone at the equator in the westerly (easterly) QBO phase (Tung and Yang, 1994a).



# Trends

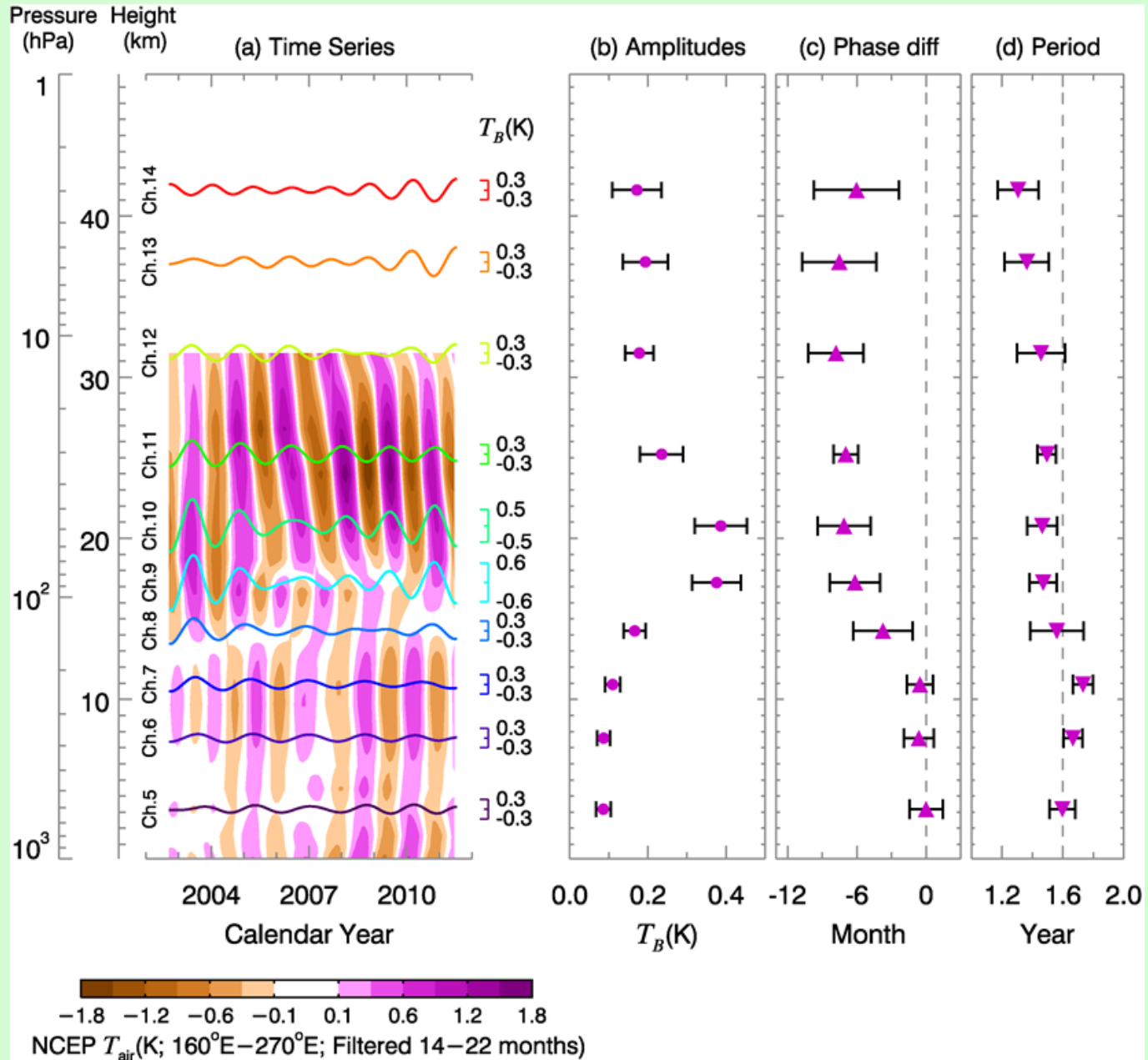
# Trend

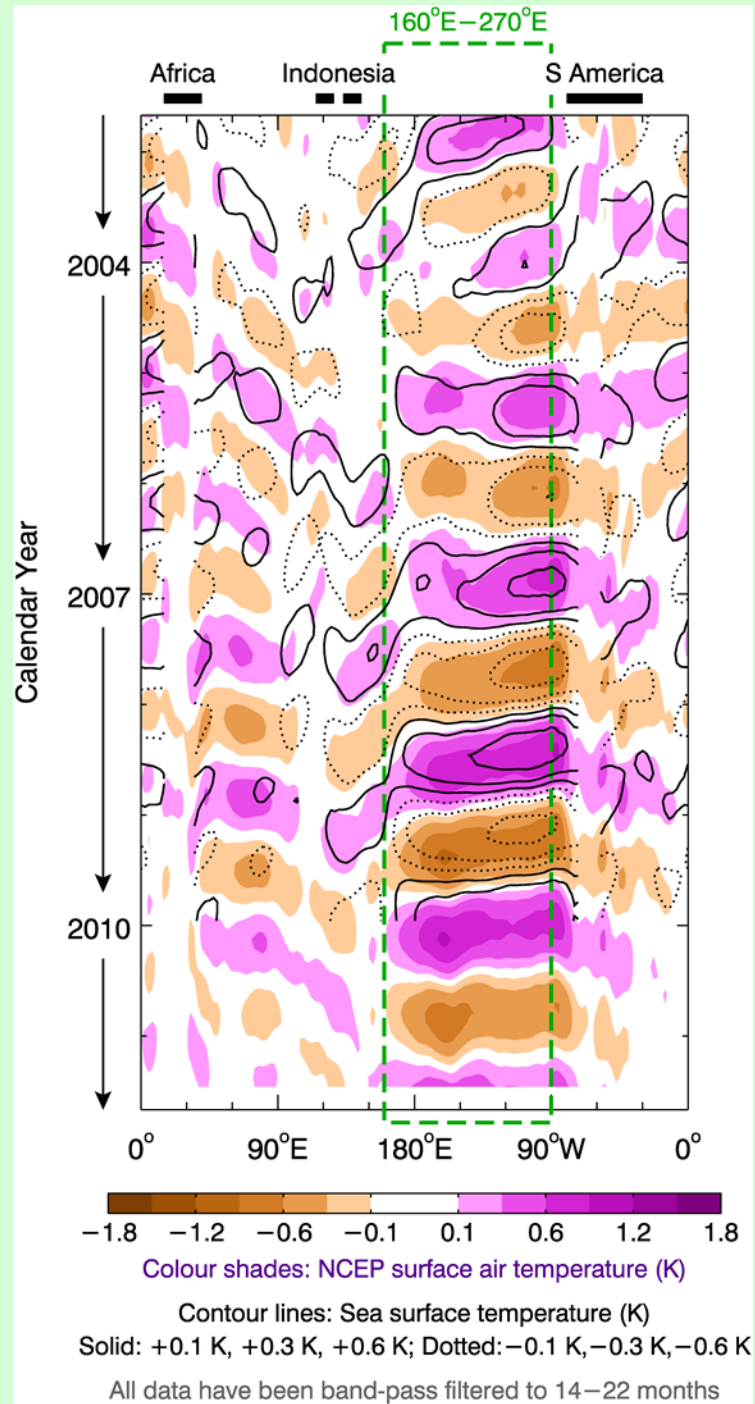


Near Annual (18 mon)



# Near Annual Mode





# Conclusions

- All natural modes found and separated, no spurious modes
- Discovered a new mode  $\sim 18$  mon
- Decadal trends are significant, probably due to couple Ocean-Atmosphere interaction

# Acknowledgements

- ❖ Yung' s Group at Caltech
- ❖ Jiang Xun (UH)
- ❖ Shi Yuan (HKU, Caltech, Princeton)
- ❖ Liang Mao-Chang (RCEC)
- ❖ NSF/NASA/JPL

Thanks

谢谢

## ***Backup Slides***



